

so much interest in scientific progress, any new development becomes so soon the centre of numberless contradictory and inaccurate reports that it is often difficult to get at the truth of the matter. Mr. Marconi's authoritative statement last Thursday is therefore very welcome. Even those most sceptical of the ultimate value of the discovery cannot but admire the energy and perseverance which Mr. Marconi has shown throughout. Whilst others have been pointing out its impracticability, he has been steadily making it practicable, and, considering the splendid results which he has already achieved, one cannot help sharing his confidence in his ultimately attaining complete success. M. S.

PROF. I. V. MUSHKETOFF.

WE regret to see the announcement of the death of Prof. Ivan Vasilievich Mushketoff, the president of the physical geography section of the Russian Geographical Society, at the age of only fifty-two.

Prof. Mushketoff was from the Don region, where he was born in 1850, and received his early education at the Novochoerkask lyceum. In 1867 he entered the St. Petersburg University, joining the philological faculty, but soon went over to the Mining Institute.

Already while a student he published his first original research on the Volhynite, and in 1872 he began his continuous, almost uninterrupted explorations of Russia, first in the Urals, where he discovered a gold-bearing formation of arsenicated minerals—pharmacosiderite, arseniosiderite, &c.—and then on the Don. Next year, 1873, he was in Turkestan, where he remained for six years, making extensive journeys. He embodied the results of his explorations in a great number of geological and geographical papers, as also in a remarkable work, "Turkestan," vol. i. (1886), which was described in these pages, and, with Prof. Romanovsky, in a geological map of Turkestan.

In 1881, Mushketoff began the exploration of the Caucasus, and especially of the Astrakhan, the Kalmyk and the Kirghiz steppes, and later on of the Transcaspian region, of which he published an excellent geological description, with a map, in 1892.

A second journey to Turkestan, in order to explore the earthquake at Vyernyi, brought Mushketoff to the study of earthquakes in Russia, for which purpose numerous regular observations and a catalogue of earthquakes (by Orloff) were published by him in the periodicals of the Geographical Society. Later on he became interested in glaciers, and organised for the International Commission on Glaciers the first regular observations in Russia upon the oscillations of the glaciers of the Caucasus. All these researches enabled him to publish the first volume of an excellent course of physical geography (1891) and a short course of petrography (1895). In 1882 he was nominated head geologist of the Geological Committee, and took, in this capacity, a lively part in the geological survey of Russia. From 1885 he was president of the physical geography section of the Russian Geographical Society, and in this capacity he took, with P. P. Semenov, the liveliest part in the organisation of all the expeditions of the Society, as well as in its publications, of which the "Annuaire" is perhaps the most remarkable for the fulness of information about all geographical, geological, geo-botanical, geo-zoological and anthropological work done in Russia.

In Mushketoff, both Russia and science have lost one of their best physical geographers. He was at the same time an excellent man, and the obituary notices published in the Russian papers represent him as a most sympathetic friend of the Russian youth. P. K.

NOTES.

M. C. ANDRÉ has been elected a correspondant of the Paris Academy of Sciences, in the Section of Astronomy.

THE council of the Zoological Society has resolved to bestow the gold medal of the Society upon Sir Harry Johnston, in consideration of his very great services to zoological science, and in commemoration of his discovery of the Okapi, and the silver medal of the Society upon Mr. E. W. Harper, of Calcutta, in acknowledgment of his numerous contributions of rare Indian birds to the Society's collection. These medals will be presented at the general meeting of the Society on June 19.

IN accordance with the usual custom, the French Physical Society announces that two meetings for the exhibition of experiments described before the Society during the year will be arranged for on Friday and Saturday, April 4 and 5. On the first evening members only will be admitted; the second will be open to visitors. The rooms of the Society (44 Rue de Rennes, Paris) will be open during the whole of the Saturday for those desirous of studying the experiments more at their leisure than is possible in a crowded meeting.

THE Belgian Royal Academy makes the following announcements as to awards of prizes on scientific subjects for 1901:—For the first question, as to the part played physiologically by albuminoid substances in the nutrition of animals or vegetables, no award has been made. For the second question, relating to the organisation and development of a Phoronis, one essay has been submitted which has been adjudged worthy of honourable mention. On the subject of the effect of external influences on karyokinesis and cell-division in plants, an essay has been submitted by Mdlle. Maria Maltaux, of Laeken, to whom a silver medal has been awarded. The Charles Lemaire prize has been awarded to M. Paul Christophe, engineer of the Belgian "Ponts et Chaussées."

MR. CARNEGIE'S gift of ten million dollars, in 5 per cent. bonds of the United States Steel Corporation, for the promotion of scientific research, has already been announced in these columns, and an outline has been given of the Carnegie Institution to be founded for this purpose (pp. 278, 302). A meeting of the trustees of the institution was held at the end of January, when Mr. Carnegie described briefly the object he had in view in making the gift, and gave emphasis to his repeated desire that the income of the fund should be largely devoted to extending human knowledge by original investigation and research. The methods by which knowledge is to be advanced are left to the free action of the trustees, who will await the carefully matured suggestions of the executive committee. "Nothing," says *Science*, "has been done in founding the new institution to further or to hinder the establishment of a national university which has been so many times proposed to Congress. Nothing is projected which will in any way interfere with the purpose of the George Washington Memorial Association to secure the funds requisite for the erection of a memorial building. Nor has there been any step taken which will prevent the Washington Memorial Institution, initiated early in the last summer, from developing plans for the introduction of students to the various scientific bureaux of Washington. The Carnegie Institution is simply a new force for the promotion of science, ready to cooperate with other institutions which are now or may be established in Washington or elsewhere."

THE Russian Geographical Society has awarded this year its Constantine medal to the geologist, K. I. Bogdanovitch, who has spent several years in the exploration of Central Asia and

has contributed one large volume to the beautiful series of quarto volumes edited by the Society and devoted to this part of Asia. The Semenoff medal has been awarded to Prof. Eduard Suess for his new classical work, "Das Antlitz der Erde," and the Prjevalsky medal to the zoologist, Prof. Zarudnyi, the author of several most valuable works on the birds and also the geography of the Transcasian region; and the author of a work, "Journey to East Persia," just published by the Society. The great gold medal of the Section of Statistics has been awarded to N. V. Slyunin, for his researches into the economical conditions of the inhabitants of the Okhotsk and Kamchatka coasts. Three small gold medals have been awarded to Messrs. N. P. Petrovsky, D. K. Zelenin and M. N. Kositch for ethnographical works published in the excellent ethnographical periodical of the Society, *Zhivaya Starina* (*Living Antiquities*). Prof. Gordyaghin, of Kazan, has been awarded the Prjevalsky silver medal for his botanical work in East Russia, and the Semenoff silver medal has been awarded to A. K. Bulatovich for his journey to Lake Rudolph. A number of small silver medals have also been awarded, chiefly for meteorological work in connection with the Society's meteorological committee, or for expeditions.

THE Elizabeth Thompson Science Fund, "for the advancement and prosecution of scientific research in its broadest sense," now amounts to 5200*l.*, and grants will be made in November from the income derived from this sum. This endowment is not for the benefit of any one department of science, but preference will be given to those investigations which cannot otherwise be provided for, which have for their object the advancement of human knowledge or the benefit of mankind in general, rather than to researches directed to the solution of questions of merely local importance. Applications for assistance from this fund, in order to receive consideration, must be accompanied by full information, especially in regard to the precise amount required; exact nature of the investigation proposed; conditions under which the research is to be prosecuted; and manner in which the grant asked for is to be expended. All applications should reach the secretary of the Board of Trustees, Dr. C. S. Minot, Harvard Medical School, Boston, Mass., U.S.A., before April 1. During the past twelve months, the following grants have been made:—30*l.* to Prof. E. W. Scripture, New Haven, Conn., for work in experimental phonetics; 60*l.* to Prof. W. Valentiner, Heidelberg, for observations on variable stars; 10*l.* to Mr. A. M. Reese, Baltimore, Md., for investigation of the embryology of the alligator; 25*l.* to Dr. F. T. Lewis, Cambridge, Mass., for investigation of the development of the vena cava inferior.

ON March 5, the Hon. Alan de Tatton Egerton, M.P., will read a paper to the Cold Storage and Ice Association, of which he is president, at the Institution of Mechanical Engineers, on the cold stores and ice factory at Knutsford.

IT is reported that Prof. Virchow continues to make satisfactory progress towards recovery. He is now permitted to make some attempts to walk, and it is hoped that he will in time regain the full use of the injured limb.

WANT of knowledge of the principles and results of vaccination and of antitoxin treatment is responsible for many incorrect opinions and for opposition to medical research. The Vaccination League has been formed with the object of extending the knowledge of the subject of vaccination, and thus, to some extent, counteract the erroneous impressions received from pamphlets prepared by anti-vaccinationists. Among the influential names recently added to the long list of vice-presidents of the League are those of the Bishop of London, Archdeacon Sinclair and Lord Newton. It will be remembered that Lord Newton recently introduced a Bill into the House of Lords on the ques-

tion of vaccination. Those who are desirous of obtaining free literature dealing with the advantages of vaccination, or of organising popular illustrated lectures on the subject in their respective districts, should apply to the secretary of the Vaccination League, 110 Strand, W.C.

THE anniversary meeting of the Geological Society was held at Burlington House on Friday last (February 21). The officers were appointed as follows:—President, Prof. C. Lapworth, F.R.S.; vice-presidents, Sir Archibald Geikie, F.R.S., Mr. J. E. Marr, F.R.S., Prof. H. A. Miers, F.R.S., and Prof. H. G. Seeley, F.R.S.; secretaries, Mr. R. S. Herries and Prof. W. W. Watts; foreign secretary, Sir John Evans, K.C.B., F.R.S.; and treasurer, Dr. W. T. Blanford, F.R.S. The following awards of medals and funds were made. The Wollaston medal to M. F. Schmidt, of St. Petersburg; the Murchison medal to Mr. F. W. Harmer; the Lyell medals to Prof. Anton Fritsch and Mr. R. Lydekker, F.R.S.; the Wollaston fund to Mr. L. J. Spencer; the Murchison fund to Mr. T. H. Holland; the Lyell geological fund to Dr. Wheelton Hind; and the Barlow-Jameson fund to Mr. W. Hutchings. The president delivered his anniversary address, which dealt chiefly with the evolution of ideas during the nineteenth century as to the genesis and classification of sedimentary and metamorphic rocks.

THE annual meeting of the Institution of Mechanical Engineers was held on Friday last. The report of the council records that the work of preparing the sixth report of the Alloys Research Committee—dealing mainly with the effect of annealing and tempering on the properties of steel—was continued in the laboratories of Sir W. C. Roberts-Austen at the Royal Mint and at the Royal College of Science until October 31; and a full report, which is now partly written, is expected to be ready during the present year. The second report of the Gas-Engine Research Committee was read and discussed at the October meeting, and the Institution has agreed to provide during the present year instruments for trials with a large experimental gas-engine which Prof. Burstall is designing to form part of the power and lighting plant in connection with the new Birmingham University Buildings. The experiments at University College, London, on the value of the steam jacket were continued during the early part of last year with the old apparatus, but were interrupted by the appointment of Prof. T. Hudson Beare to a chair in the University of Edinburgh. The apparatus has been removed from London to Edinburgh, and Prof. Beare is now designing several improvements in the valves for the admission and exhaust of the steam into the hot pots of the apparatus. As soon as these new valves are made, the experiments will be resumed, and it is hoped more satisfactory results will be obtained with this new apparatus. The series of experiments at King's College on the compound steam-jacketed engine has been completed, and Prof. David S. Capper has promised his report early this year. A second series of tests with unjacketed cylinders has been commenced, and is being carried through at the same speeds and steam pressures as the first jacketed series. Direct comparisons can then be made both with and without steam jackets. The council has joined with the councils of the Institution of Civil Engineers, the Iron and Steel Institute and the Institution of Naval Architects in forming a committee, to be called "The Engineering Standards Committee," for the purpose of recommending standard sizes for rolled sections, and other matters. The question of standardising pipe flanges, being of great importance at the present time, will be dealt with in a paper to be read before the Institution at an early meeting.

THE death is announced, at Vienna, of Dr. Emil Holub, the famous African explorer. From an obituary notice in the *Times*, we learn that Dr. Holub, who was a native of

Bohemia, was of Czech descent. He was born in the small town of Holics on October 7, 1847. After practising for a time as an apothecary, his scientific leanings and his adventurous spirit led him, at the age of twenty-five, to emigrate to South Africa. His principal inducement to explore the land beyond the Zambesi was his love of natural history, and more particularly his interest in ornithology. Indeed, the first period of seven years spent by him in South Africa was mainly devoted to ornithology and to zoology in general. On his return to Europe he took up his residence at Prague, and afterwards in Vienna, where he prepared his "Beiträge zur Ornithologie Südafrikas" ("Contributions to the Ornithology of South Africa"). A little later he published "Seven Years in South Africa" and "The Colonisation of Africa." At this time he devoted himself seriously to the study of astronomy and geography, having during his first journey been greatly hampered, as he was always the first to confess and deplore, by his lack of physical and mathematical knowledge. His explorations, therefore, had been rather those of a zoologist than of a geographical explorer. Having resolved to overcome this difficulty, he set to work, and when, in 1883, he landed on African soil for the second time he was probably as well equipped as any of his predecessors in African exploration. After a little delay, Dr. Holub proceeded to the country of the Mashukulumbé, into which he penetrated further than any European had done before him. There, accompanied by his wife, he spent four years, returning to Europe in 1887. His book, entitled "From Cape Town to the Country of Mashukulumbé," which contains a record of his labours, has become a standard work. Like his former publications, it has been translated into many languages.

THE German Physical Society's publication, *Die Fortschritte der Physik*, has, under the editorship of Profs. Scheel (for pure physics) and Assmann (for cosmic physics), fairly succeeded in attaining the maximum efficiency in keeping up to date with the most recent papers, consistently with its appearance as a yearly volume. In order to accelerate further the issue of a summary of current literature, Messrs. Fried. Vieweg and Son, of Brunswick, now announce the publication, in connection with the *Fortschritte*, of a *Halbmonatliches Literaturverzeichnis*, which will furnish the physicist at fortnightly intervals with a list of papers and books classified under the various branches of physics. The first and second numbers contain forty and twenty pages respectively. The titles only of the papers are given, so each page contains the names of some five-and-twenty different papers. The subscription price of the *Literaturverzeichnis* is only 4 marks per annum, so it should soon find its way into the library of every physicist.

THE *Bulletin* of the French Physical Society, No. 174, describes briefly some important experiments by M. Marey on the motion of fluids studied by photography. In the case of liquids, M. Marey was successful, as long ago as 1893, in studying the motions by means of beads of the same specific gravity as the liquid. He has recently succeeded in studying the movement of air-currents past a fixed obstacle by means of smoke filaments, obtained by filtering the air-current through silk gauze with even meshes, the smoke being photographed by means of magnesium light. Where no obstacle exists, the filaments of smoke are rectilinear and parallel, while if an inclined plane be placed in the current, they will be seen to indicate the form of the stream lines, some bending round the upper and others round the lower edge. To obtain the velocity of the current at different points, a lateral oscillatory motion of ten periods per second is given to the screen, when the smoke filaments assume a sinusoidal form which is preserved throughout their path and the distance between the inflexions at any point

determines the velocity. When the experiments were repeated under identical conditions, the two images were found to agree to such an extent as to be capable of superposition.

IN connection with the wreck of *Santos Dumont* No. 6, Dr. J. Y. Buchanan, F.R.S., has written a letter to the *Times* which may serve to correct any false impressions that may have been formed as to the value or general conclusions of the experiments. It is pointed out that "to M. Dumont himself every fresh ascent, whether the public term it a success or a failure, is full of lessons on a quantity of matters of detail of which the uninitiated can have no perception. Indeed, the more complete the apparent failure, the greater is the value of the experience to the air pilot, provided he escape so as to be able to utilise the experience himself." Since Dr. Buchanan arrived at Monaco, M. Dumont has taken his balloon out three times. The first time (on February 10) the balloon completely outstripped the Prince of Monaco's launch, and was even estimated to achieve 15 knots relative to the ground, going against a breeze. But "the most striking and at the same time unfavourable feature was the heavy pitching of the balloon, which at times attained an amplitude of not far from  $45^\circ$  on each side the vertical." On the 11th, M. Dumont performed his most successful journey in the direction of Cap Martin and back, the balloon pitching much less than previously. The accident which occurred on the 14th appears to have been mainly due to this pitching. "Arrived abreast the pigeon-shooting ground, the pitching became more violent, and the balloon rose, taking the guide-rope, which usually trails on the surface of the water, entirely out of the water and to a height of fifty yards or more above it. The situation was now becoming critical. In pitching, the balloon came to be standing very nearly vertically, first on one end and then on the other." M. Dumont appears then to have let out gas, which had the effect of causing the rear and lower end to collapse, and the rudder was thereby rendered useless. From this time until M. Dumont was rescued, wet and bedraggled, from the wreck, frequent photographs were taken showing the form assumed by the balloon during its gradual deflation. Two conclusions are drawn from the experiments; firstly, that the pitching must be prevented by the application of aeroplanes or side pieces performing the functions of bilge keels, or by other means, and, secondly, the great difficulty attaching to the ellipsoidal balloon as compared with the typical one of spherical or more strictly pear-shaped form, in that the former tends to revert to the spherical shape as soon as it is somewhat deflated, while the latter better preserves its natural form in shrinking.

A WRITER in the *Dumfries and Galloway Standard and Advertiser* (February 12) directs attention to a curious anticipation of a magnetic means of communication contained in the following paragraph from the *Spectator* of December 6, 1797:—"Strada, in one of his prolusions, gives an account of a chimerical correspondence between two friends by the help of a certain loadstone, which had such virtue in it that if it touched two several needles, when one of the needles so touched began to move, the other, though at never so great a distance, moved at the same time, and in the same manner. He tells us that the two friends, being each of them possessed of one of these needles, made a kind of a dial plate, inscribing it with the four and twenty letters, in the same manner as the hours of the day are marked upon the ordinary dial plate. They then fixed one of the needles on each side of these plates in such a manner that it could move round without impediment so as to touch any of the four and twenty letters. Upon their separating from one another into different countries, they agreed to withdraw themselves punctually into their closets at a certain hour of the day, and to converse with one another by means of this their invention. Accordingly, when they were some hundreds of miles

asunder, each of them shut himself up in his closet at the time appointed and immediately cast his eyes upon his dial plate. If he had a mind to write anything to his friend, he directed his needle to every letter that formed the words which he had occasion for, making a little pause at the end of every word or sentence to avoid confusion. The friend, in the meanwhile, saw his own sympathetic needle moving of itself to every letter which that of his correspondent pointed at. By this means they talked together across a whole continent, and conveyed their thoughts to one another in an instant over cities or mountains, seas or deserts."

PROF. A. AGASSIZ and his party have returned to Colombo, after spending a few weeks in the exploration of the Maldives. From the *Ceylon Observer* we learn that about three hundred photographs were taken, principally of coral-reef subjects. The principal work done was the sounding of the channels between the lagoons and the development of the plateau on which the atolls of the Maldives have been formed. The principal atolls are separated by comparatively shallow water in the central part of the group, while towards the south, between Hadumati and Suvadiva and Addu, the depths are very much greater—nearer a thousand fathoms. A line was run to the westward of Ari Atoll into fifteen hundred fathoms, and one to the southward of South Male into twelve hundred fathoms, showing that the plateau of the Maldives is much steeper on the west than on the east face. Soundings were also taken between the northern Maldives and Colombo, and they show that the Maldives are separated from the Indian continental slope by a deep bank of the ocean of more than fifteen hundred fathoms in depth. The atolls of the Maldives are said to exhibit the most simple and primitive conditions for the formation of atolls which are found anywhere except in some parts of the Yucatan plateau in the West Indies. Atolls can be found in all stages of growth, from a mere bank rising to a few feet above the plateau to banks within five or six fathoms from the surface or to banks which have just reached the surface and on which sandbanks or islets are beginning to forms. Prof. Agassiz says that one reason for the success of his expedition is that the charts published more than seventy years ago are as accurate to-day as they were then. The only changes noticed were changes such as the washing away of banks or the formation of banks since the charts were published; but these are changes without any special importance.

WE have received the Report of the Meteorological Commission of the Cape of Good Hope for the year 1900. The Commission has had to contend with considerable difficulty owing to the irruption of hostile bands into Cape Colony and the wanton destruction of many instruments. Nevertheless, it is able to report that the interest shown in the subject both by observers and the general public continues to grow, and that observations have been restarted at Johannesburg and Kimberley. Compared with the previous year, there has been a considerable increase in the number of observers, especially at rain-gauge stations, which now number 447. An investigation is being made into the connection between the weather and the plague in Cape Town. The result goes to show that each marked rise in temperature was followed in a period of from ten to fourteen days by an increase in the number of plague cases. The Commission has also taken up the investigation of ocean currents with the cooperation of the Union-Castle Steam-ship Company, whose captains are instructed to throw bottles overboard at fourteen different points along the coast. Among various papers which have recently been read before the South African Philosophical Society may be mentioned one of especial interest on some periodical changes in the rainfall at the Royal Observatory, since 1841, by Prof. J. T. Morrison, in which

evidence is shown of two prevailing periodicities running simultaneously through the monthly amounts, and completing themselves in ten years and in slightly over nine years respectively. The author also finds a well-marked periodicity of about sixty years, but its exact period has not yet been determined.

THE Meteorological Office pilot chart of the North Atlantic and Mediterranean for the month of March states that, although there is a general diminution in the strength of the winds at this season, gales are still of frequent occurrence, especially on the western half of the ocean, where, over a considerable area, the frequency is from 25 to 36 per cent. This locality is indicated on the inset chart of mean barometric pressure by a closing up of the isobars. The prevalent north-easterly winds in the neighbourhood of the British Isles are associated with the dipping of the isobars south-eastwards towards Spain. On the Gulf of Mexico the "northerners" are becoming less frequent, but they undergo certain important modifications. They are shorter in duration and are accompanied by finer weather, but they blow with greater violence during the first twenty-four hours of their continuance and draw less to the north-east. Fog on the Banks having reached its minimum in February is now spreading east and west, and mariners are cautioned against hugging the coasts of the United States during the prevalence of east winds, and particularly gales, as the low shores are then hidden in fog. Two inset charts are given to illustrate the north-easterly type of weather over western Europe, one being the blizzard of March, 1891, when many of our southern counties were buried deep under snow. One result of the presence of these spring north-east winds is seen in their marked influence on the currents. Not only is there a south-westerly set traceable from the Channel soundings, but even northward of the 50th parallel there is a westerly flow to about 22° W., where it curves to southward and south-eastward and merges in the south-westerly set near the 40th parallel. The Gulf Stream water is thus kept away from our south-western shores at this season, but out on the ocean its flow can be traced north-eastward to the neighbourhood of Rockall. No ice appears to have been reported since the early part of December.

THE issue of the pilot chart referred to in the foregoing note completes the series for a whole year, and investigators have now at their service a most valuable summary of the salient features of the various elements month by month. The circulation of the ocean waters will attract most attention, because the currents of the Atlantic have never before been published for each of the twelve months, and as the results here given are based on observations extending over the very long period of sixty-five years, they are as complete as can be hoped for. Commander Hepworth has been singularly successful in his selections of weather types and other matter for the several months, many of them being justified in the course of the period covered, such, for instance, as the northerlies in May, the summer thunderstorms, the September hurricane near the Cape Verde Islands, the recent exceptionally high barometer (31.11 in.), and the dust storm off north-west Africa in January, &c. Reports from different parts of western Europe indicate very clearly that the sand precipitated in South Wales and the south-west of England on January 22 and 23 had travelled northward from the sandstorm experienced about the Canaries and Madeira on the 17th and 18th, when an easterly gale was blowing from the African mainland.

So comparatively easy has it now become to obtain good photographs by means of flashlight that pictures of places situated under the level of the earth's surface are not uncommon. So interesting are some of these underground passages, caves and grottoes, and so great is the chance that as time goes on they will undoubtedly be

deprived of their natural charms, it seems only right that their features should be at once rendered permanent by means of photography and kept as records for future generations. As pointed out in the current number of the *British Journal of Photography* (February 14), we have not necessarily to leave our own country in search of such subterranean cavities, for we have in Yorkshire, Derbyshire, Thanet and other parts of the country grottoes which are well worth seeing and photographing. Why, then, should not these British caves be treated in the same way as has recently been done for the famous grotto of Han? This subterranean paradise, as it has been called, has lately been photographed with great success and the pictures published in a booklet entitled "The Wonders of the Grotto of Han." In some cases, magnesium light was used as an illuminant, while in others the electric light which adorns the principal galleries of the cavern was sufficient. Even if it were impossible to get sufficient light for such dark interiors by flash, the above-mentioned journal suggests that there is no reason why a time exposure should not be made, making use of a pyrotechnic composition with magnesium or aluminium as its base.

MESSRS. W. M. MORDEY and B. M. Jenkin, in their paper on electrical traction on railways, which was read before the Institution of Civil Engineers last week, dealt with the relative merits of direct-current, alternate-current and composite systems. The present time is opportune for such a paper, as the electrification of some of the larger railways is being more or less seriously discussed. In this country, as the recent Inner Circle arbitration showed, direct-current driving is favoured, the system being generally a composite one, with generation of alternating current at high voltage and conversion to direct-current at 500 volts at substations. On the Continent, as the authors pointed out, there is a tendency to work out the more difficult problems in traction work by the use of three-phase alternating current for both transmission and driving. After summing up the requirements that should be met by any general system of electrical railway working, the authors concluded that the distribution of power is best effected by single-phase alternating current. The Ward Leonard system of utilising such current was then discussed in detail; by this the current is supplied to a single-phase motor on the train which drives a dynamo, which in turn drives the direct-current train motor. This method, though it appears complex, is, they consider, the one best satisfying all the conditions for a general electric traction system.

MR. W. L. SCLATER'S illustrated notice of that remarkable bird, the ground-hornbill (*Bucorax cafer*) of South Africa, which appears in the February issue of the *Zoologist*, will be read with interest by ornithologists. These birds, which are generally seen in the open, live entirely on the ground, and wander about in parties of five or six. It is believed that several females lay in the same nest, which is situated in a hole high up in the stem of a tree.

To the *Revue générale des Sciences* for September 15, Prof. A. Forel contributes a long article on the psychic faculties of insects. According to the author, these creatures are certainly endowed with four senses, namely sight, smell, taste and touch, the possession of hearing being doubtful. Some writers attribute to them a "photodermatic" sense, but this is merely a modification of touch. After describing the location of each of these senses, the author proceeds to discuss the powers of perception, volition and "sentiment" possessed by insects, concluding with a comparison between their intellect and that of man.

THE February number of the *Zoologist* contains Mr. T. Southwell's account of sealing and whaling for the past year. For the first time for an unknown period, no British whaler

visited the sea between Greenland and Spitzbergen. Davis Strait, on the other hand, was visited by several vessels, and whales were by no means scarce, although, owing to bad weather, captures were not numerous and two whales were lost after being killed. One whale with whalebone close on twelve feet long was secured. The price of whalebone during the season was 1450*l.* per ton, but it is now said that 2000*l.* is being asked. The Newfoundland sealing was fairly successful, and was remarkable for the early date at which the vessels completed their cargoes. The Gulf sealing, on the contrary, was a practical failure.

AN influential committee has been appointed to promote a "nature-study" exhibition to be held in London about the end of July. It is suggested that the exhibition should be open to urban and rural elementary day schools, continuation schools, higher-grade schools (boys and girls), Home Office schools, secondary schools (boys and girls), and other institutions and colleges, and that prizes or certificates should be offered in each class for (1) The best collection of common dried plants, injurious insects, &c., apparatus for class lessons, drawings made in class of natural objects, home-made maps with a school as centre, showing features of interest within a radius of two or three miles of the school, note-books, natural history calendars, plans of gardens, photographs, models in clay or plasticine of natural objects, plants grown in boxes and pots, and rustic carpentry. Schools would not be restricted to these exhibits, nor would they be required to send all of them. Teachers would use their own discretion in sending what they believe will most fully illustrate their courses in "nature-study." Specimens of rare plants would not be asked for, and the uprooting of any plant would be especially forbidden. (2) The best individual exhibit of one pupil's work. (3) The best scheme of instruction and descriptive account of work, methods, &c. There should be no difficulty in obtaining the necessary funds for such an excellent object.

THE discourse on "The Discovery of the Future," delivered at the Royal Institution on January 24 by Mr. H. G. Wells, and printed in our issue of February 6, has been published in book form by Mr. T. Fisher Unwin.

MR. W. A. SHENSTONE'S little book on "The Methods of Glass Blowing" (Longmans, Green and Co.) is favourably known to all who have cultivated the art for the purposes of constructing physical and chemical apparatus and accessories. The practical hints on glass-blowing contained in the book are the result of long practice at the blow-pipe, and experience of the requirements of laboratories. The fourth edition of the book, which has just been published, contains a new chapter in which Mr. Shenstone describes the methods of working silica in the oxy-gas flame, a subject to which he has given particular attention.

THE presidential address delivered at the Philadelphia meeting of the Chemical Society by Prof. F. W. Clarke appears in a recent number of *Science*. The address deals with the development of chemistry, and is an interesting discussion of the progress and prospects of chemical science. Prof. Clarke considers that the chief need of chemistry at the present time is the better organisation of research. Whilst fully appreciating the great work that is done by individuals working independently in the field of science, he thinks that collaboration and systematisation are urgently required. He maintains that either by public expense or by private enterprise, laboratories for research should be established in all civilised countries. By conference between them, the work should be so adjusted as to avoid repetition, each one reinforcing the others. Their primary function should be to perform the drudgery of science, to undertake the tedious, laborious, elaborate investigations

from which the solitary worker shrinks, but which are, nevertheless, essential to the development of chemistry. Brilliant discoveries might be made in them, but incidentally, and not as their main purpose.

THE table of atomic weights issued annually by the international committee appears in the January number of the *Berichte*, and the table, based upon oxygen=16, is unaccompanied by the didactic table with hydrogen=1. The withdrawal of the didactic table is in accordance with a widely expressed wish. It is generally felt that if oxygen is to be taken as 16 for any purpose it should be taken as 16 for all purposes. Discussing this subject in a paper recently contributed to the American Society of Sciences and Arts, Prof. Richards made a strong appeal to chemists to conform to the decision of the international committee. He pointed out that oxygen has actually served as the experimental standard of reference in a great majority of cases, that the great bulk of valuable work has already been published on the basis oxygen=16.000, and that the use of this standard involves no important didactic difficulties. He contends that the decision of the representatives of the international committee is in itself an important reason for adopting this standard, and that uniformity of usage is more important than any of the special advantages claimed by either side in the discussion. The only alterations of atomic weights in this year's table are of calcium from 40 to 40.1, iron from 56 to 55.9, and tellurium from 127 to 127.6.

THE additions to the Zoological Society's Gardens during the past week include two Guinea Baboons (*Cynocephalus sphinx*), a Red-footed Ground Squirrel (*Xerus erythropus*) from West Africa, presented by Captain R. H. Wilford; a Snow Leopard (*Felis uncia*) from Northern India, presented by Captain H. Nicholl; two Half-collared Turtle Doves (*Turtur semitorquatus*) from West Africa, presented by Captain Thorne; a Ring-necked Pheasant (*Phasianus torquatus*) from China, presented by Mr. B. Tufnell; seven Black-headed Gulls (*Larus ridibundus*), a Common Gull (*Larus canus*), European, presented by Mr. E. J. W. Eldred; a Green Monkey (*Cercopithecus callitrichus*), an Erxleben's Monkey (*Cercopithecus erxlebeni*), eight West African Love-Birds (*Agapornis pullaria*) from West Africa, a Greater Sulphur-crested Cockatoo (*Cacatua galerita*) from Australia, a Levaillant's Amazon (*Chrysotis levaillanti*) from Mexico, ten Common Toads (*Bufo vulgaris*), European, a Loggerhead Turtle (*Thalasseochelys caretta*) from Tropical Seas.

### OUR ASTRONOMICAL COLUMN.

#### ASTRONOMICAL OCCURRENCES IN MARCH.

- Mar. 3. 22h. Vesta in conjunction with the moon. Vesta  $0^{\circ} 35' S.$   
 5. 15h. Saturn in conjunction with the moon. Saturn  $5^{\circ} 1' S.$   
 6. 14h. Jupiter in conjunction with the moon. Jupiter  $5^{\circ} 41' S.$   
 7. 7h. Venus in conjunction with the moon. Venus  $2^{\circ} 11' N.$   
 12. 10h. 12m. Minimum of Algol ( $\beta$  Persei).  
 15. 7h. 1m. Minimum of Algol ( $\beta$  Persei).  
 15. Venus. Illuminated portion of disc = 0.198, Mars = 1.000.  
 17. 2h. om. Mercury at greatest elongation ( $27^{\circ} 41' W.$ ).  
 17. 9h. 19m. to 10h. 16m. Moon occults 26 Geminorum (mag. 5.1).  
 18. 5h. 48m. to 6h. 14m. Moon occults 68 Geminorum (mag. 5.0).  
 18. 15h. 19m. to 10h. 58m. Transit of Jupiter's Sat. III.  
 20. 8h. 27m. to 9h. 43m. Moon occults  $\omega$  Leonis (mag. 5.6).  
 20. 19h. om. Venus at maximum brilliancy.

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- Mar. 21. 1h. om. Sun enters Aries. Spring commences.  
 21. Saturn. Outer minor axis of outer ring =  $13'' 75.$   
 22. 11h. 19m. to 12h. 24m. Moon occults  $\rho^5$  Leonis (mag. 5.5).  
 28. 13h. 41m. to 15h. om. Moon occults  $\nu$  Scorpii (mag. 4.5).  
 29. 13h. Mars in conjunction with sun.

OBSERVATIONS OF 900 DOUBLE AND MULTIPLE STARS.—The first of the astronomical series of publications from the University of Pennsylvania consists of the measures of 900 double and multiple stars made by Prof. Doolittle with the 18-inch refractor of the Flower Observatory. These observations were made during the period 1897 January 1 and 1900 October 15. In all cases a power of 592 diameters was employed. Twenty-two of the stars are now catalogued for the first time, having been discovered during the observation of neighbouring doubles.

The 18-inch objective is the largest lens made by Brashear up to the present time, and has given every satisfaction, both as to resolving and light-grasping power. The mounting, by Warner and Swasey, is of similar construction to the Lick and Yerkes instruments (*Publications of the University of Pennsylvania, Astronomical Series*, vol. i. part iii.).

OBSERVATIONS OF 194 DOUBLE STARS.—*Bulletin* No. 11 from the Lick Observatory contains a list of observations made by Mr. R. G. Aitken during 1900 and 1901 with the 36-inch and 12-inch refractors. Many of the stars are difficult pairs, and in most cases the 36-inch telescope was employed, with powers ranging from 1000–2400.

### RADIO-ACTIVITY AND THE ELECTRON THEORY.<sup>1</sup>

ELECTRONS emanating from radio-active bodies behave like material particles, and are impeded by the molecules of the surrounding medium, in contrast with ether waves, which are not thus affected except by absorption. It is not difficult to put these indications to test. A pair of shallow cells, A B (Fig. 1), 1.5 mm. deep and 25 mm. square, were made by cementing slips of glass to a thick glass plate. The cells were filled to the same depth with a radio-active substance chiefly containing actinium.<sup>2</sup> Over cell A was placed a piece of thick lead pipe, 28 mm. high and 25 mm. internal diameter, to ensure that any emanations from the active substance in A would be confined to the inside of the hollow cylinder. The radio-active substance in B was freely exposed to the air, save for a pillar of lead at C, to support the sensitive film. A sensitive film was laid horizontally over the cylinder and support C. On the film was a plate of glass, and cylinder and film were pressed together by heavy weights. The whole was covered in a light-tight box and put in a dark cupboard.

At the end of forty-eight hours the film was removed and developed. There was a strong action shown over cell A (the one covered by the lead cylinder), but over B, the cell exposed to the air, there was no visible impression. Measured in Mr. Chapman Jones's "Opacity Meter"<sup>3</sup> the results were:—

Image over cylinder—Opacity log.<sup>4</sup> = .79; Opacity<sup>5</sup> = 6.17.

The experiment was repeated, using the same apparatus, but a different preparation of actinium. In this case the exposure was for seventy-two hours. As before, there was a strong impression over cell A and none over cell B. The figures were:—

Opacity log. = .89; Opacity = 7.71.

These experiments indicate that the electrons from the radio-active agent, chiefly actinium, partake of the properties of a fog or mist of material particles, capable of diffusing away in the free air like odoriferous particles, when not kept in by a thick metal screen.

A further experiment was now tried with the same apparatus, the agent a strongly active radium and barium bromide. This material being self-luminous, a sheet of black paper was placed

<sup>1</sup> By Sir William Crookes, F.R.S. A Paper read before the Royal Society on February 6.

<sup>2</sup> The body I called Uranium X in my Royal Society paper, May 10, 1900, has since proved to be M. Debiere's Actinium.

<sup>3</sup> *The Photographic Journal*, vol. xx. p. 86, December 21, 1895.

<sup>4</sup> The opacity logarithm represents the density of the image, absolute density being represented by 2.00.

<sup>5</sup> The "opacity" is the whole number corresponding to the "opacity log." The "opacity" is directly proportional to the photographic energy acting on the sensitive surface.